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Hornsby et al.

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(45) **Date of Patent: Jul. 11, 2017**

(54) **FLUID DISPENSER**

(71) Applicant: **S. C. Johnson & Son, Inc.**, Racine, WI (US)

(72) Inventors: **James Russell Hornsby**, St. Louis, MO (US); **Joseph Lee McGowan**, St. Charles, MO (US)

(73) Assignee: **S. C. Johnson & Son, Inc.**, Racine, WI (US)

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E03D 9/02 (2006.01)
E03D 9/00 (2006.01)

(52) **U.S. Cl.**
CPC ***E03D 9/005*** (2013.01)

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USPC 4/223
See application file for complete search history.

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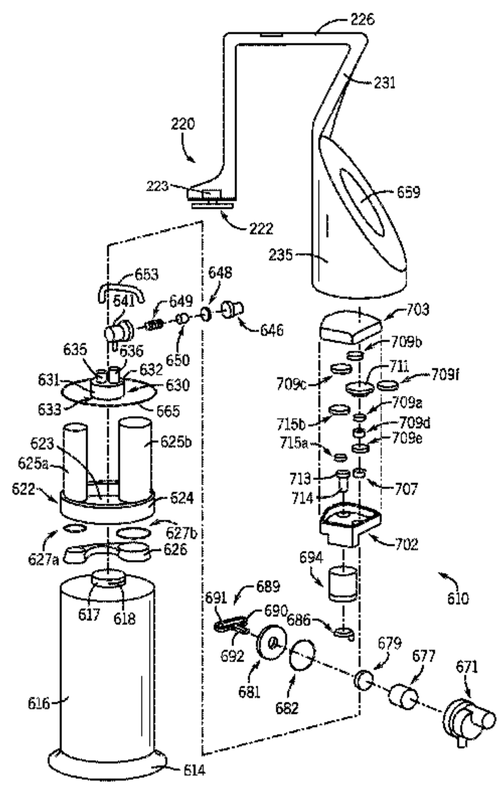
Primary Examiner — Huyen Le

(57) **ABSTRACT**

A device for spraying an inner surface of a wall of an enclosure with a fluid is disclosed. The device includes a reservoir for the fluid, a nozzle assembly through which the fluid can be sprayed on the inner surface of the wall of the enclosure, a fluid conduit in fluid communication with the reservoir and the nozzle, a pump for delivering fluid from the reservoir through the fluid conduit and to the nozzle when the pump assembly is activated, and a controller in electrical communication with the pump wherein the controller executes a stored program to activate and deactivate the pump. The nozzle assembly includes a nozzle which directs the fluid in a fluid path, and the nozzle assembly further includes a deflection shield that is dimensioned to contact and redirect fluid in the fluid path, and the nozzle assembly further includes mounting structure for attaching the nozzle near the inner surface of the wall of the enclosure. The flow off of the deflector shield is laminar.

16 Claims, 11 Drawing Sheets



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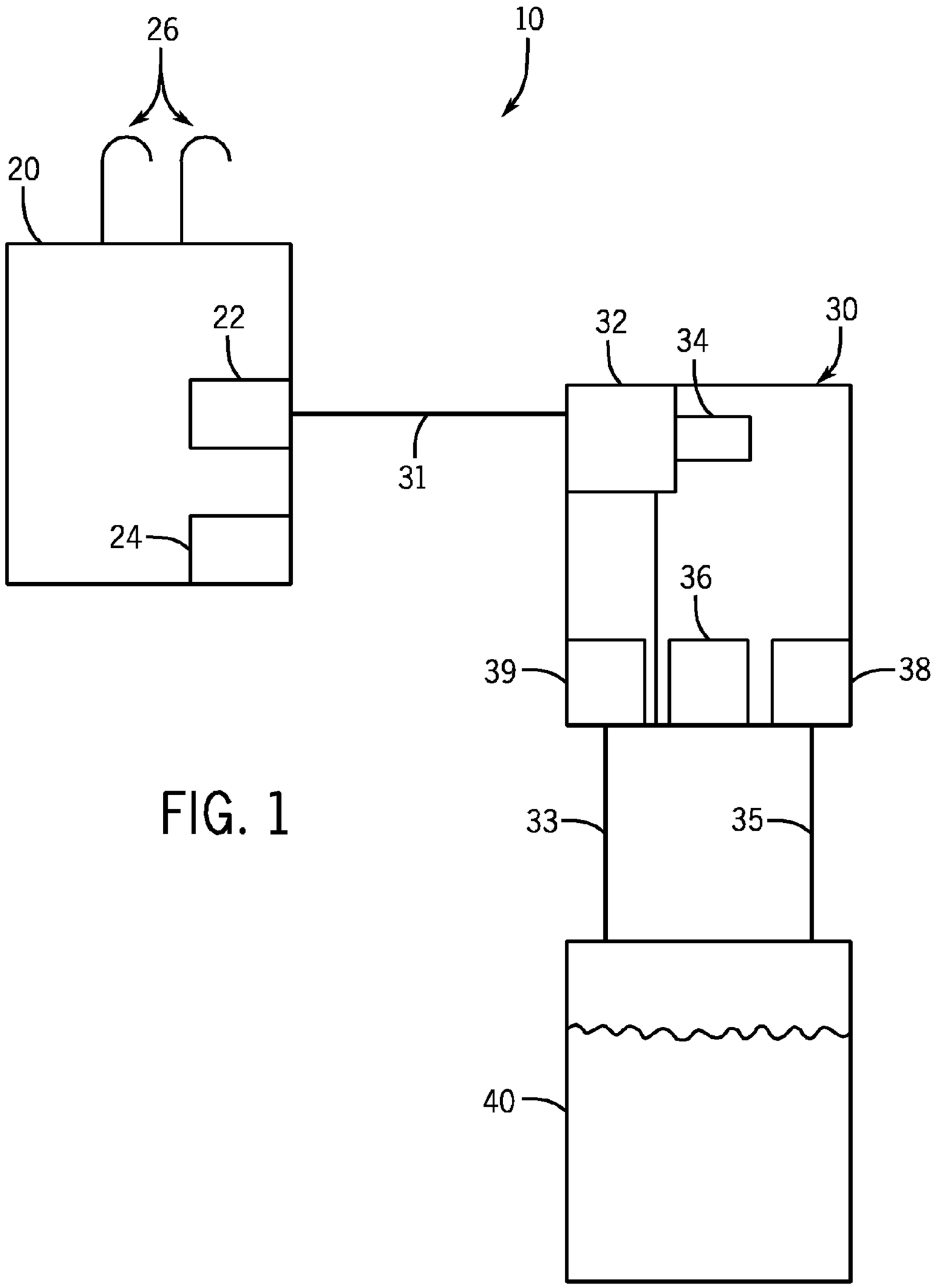

FIG. 1

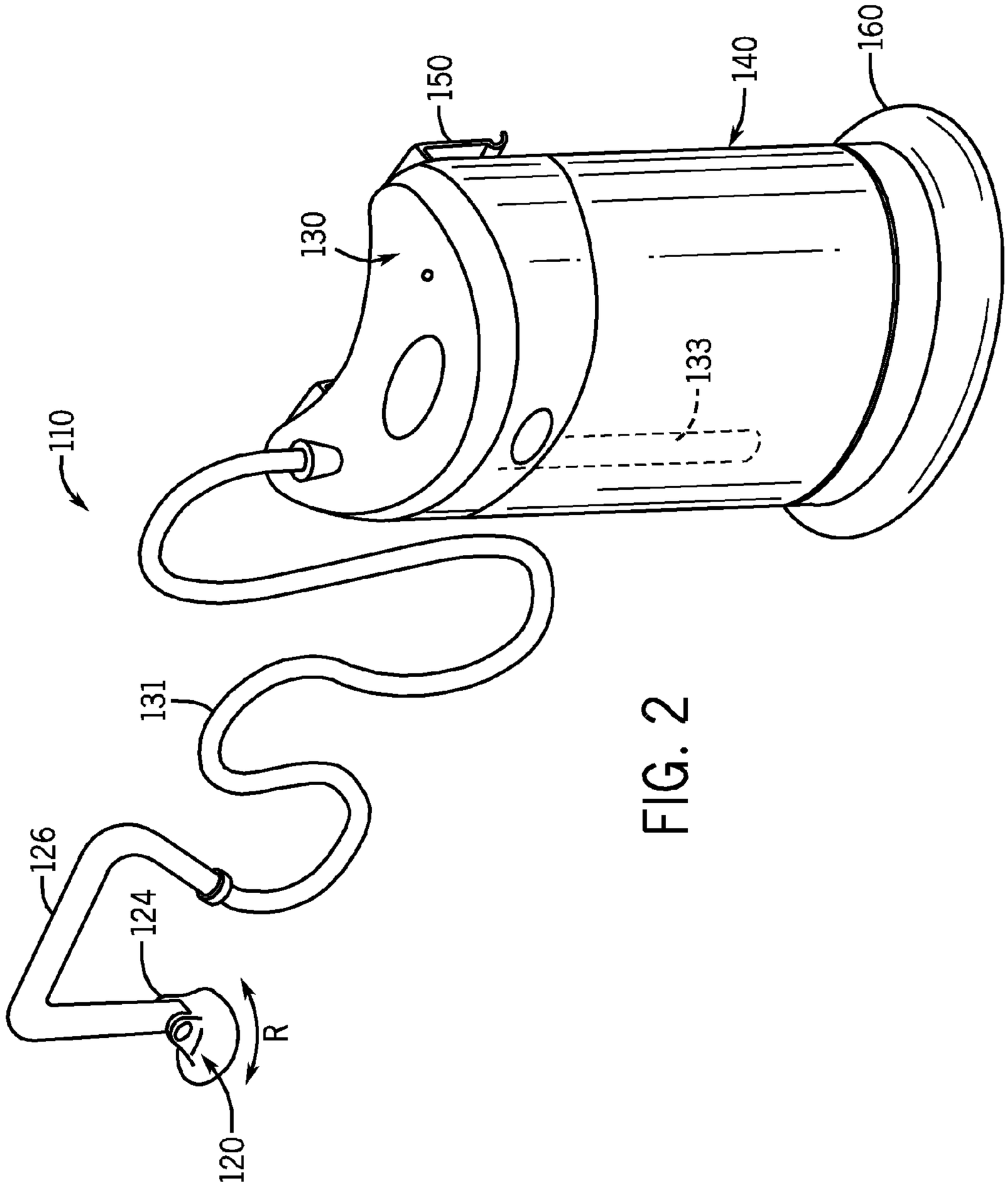

FIG. 2

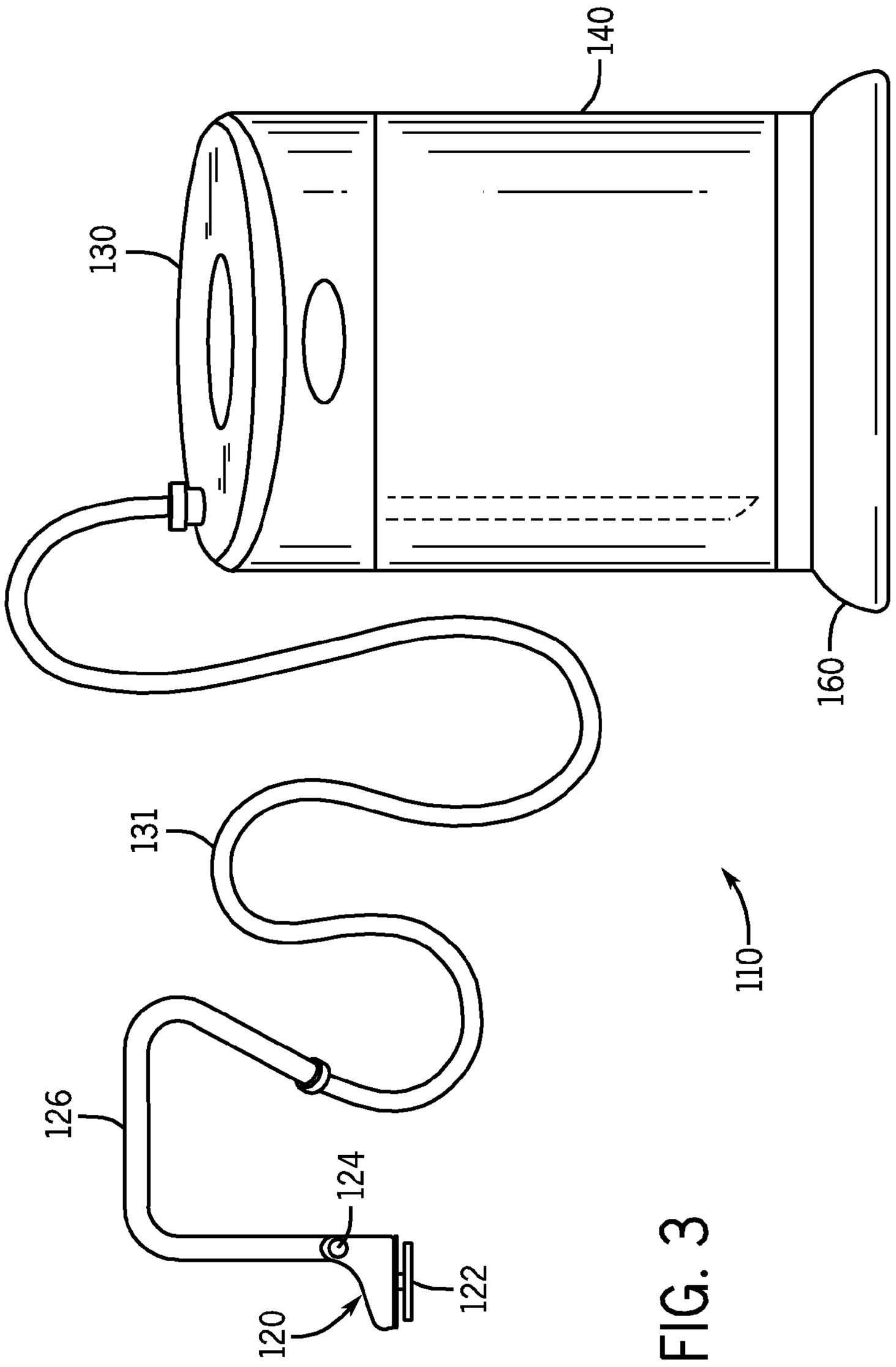

FIG. 3

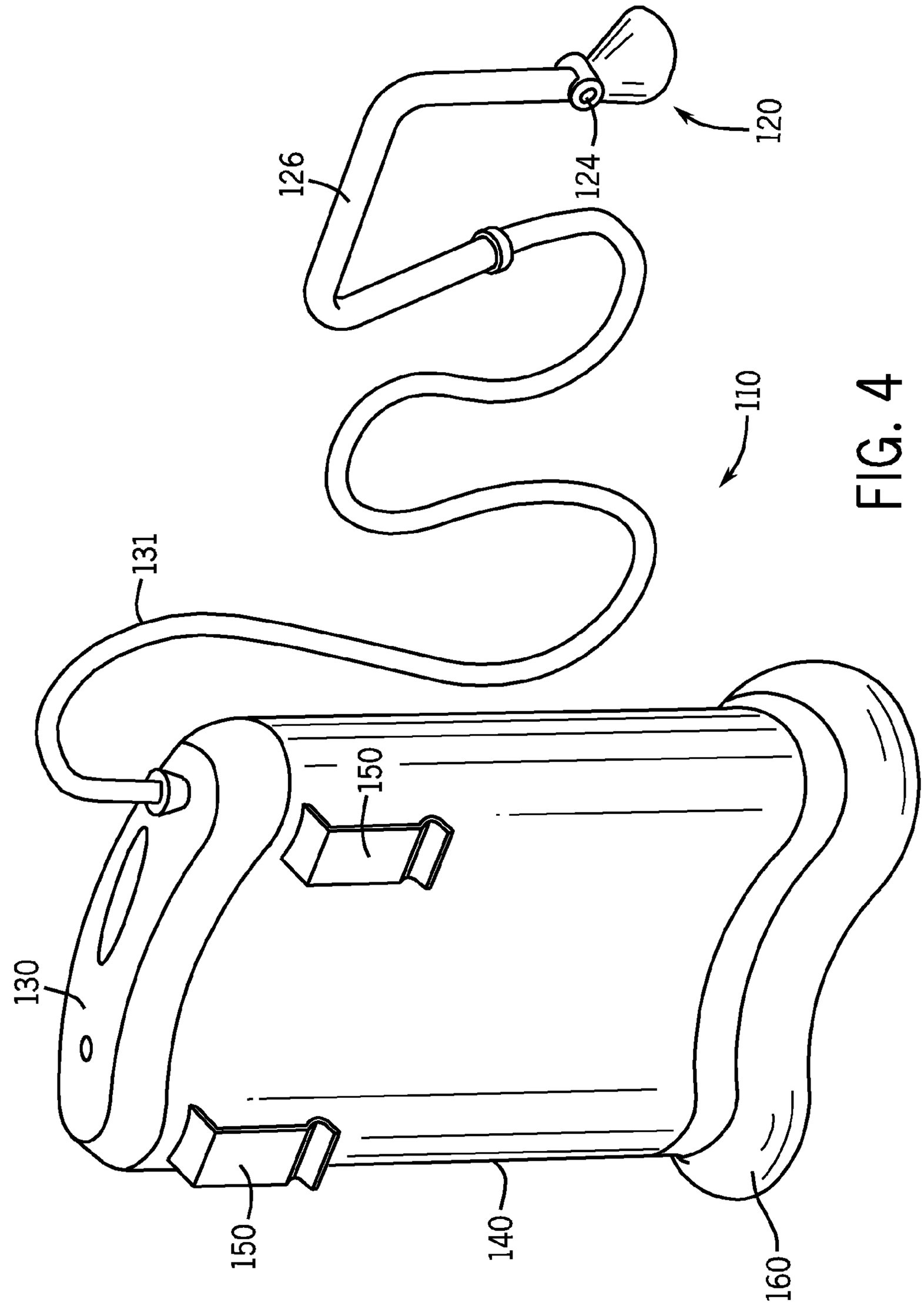

FIG. 4

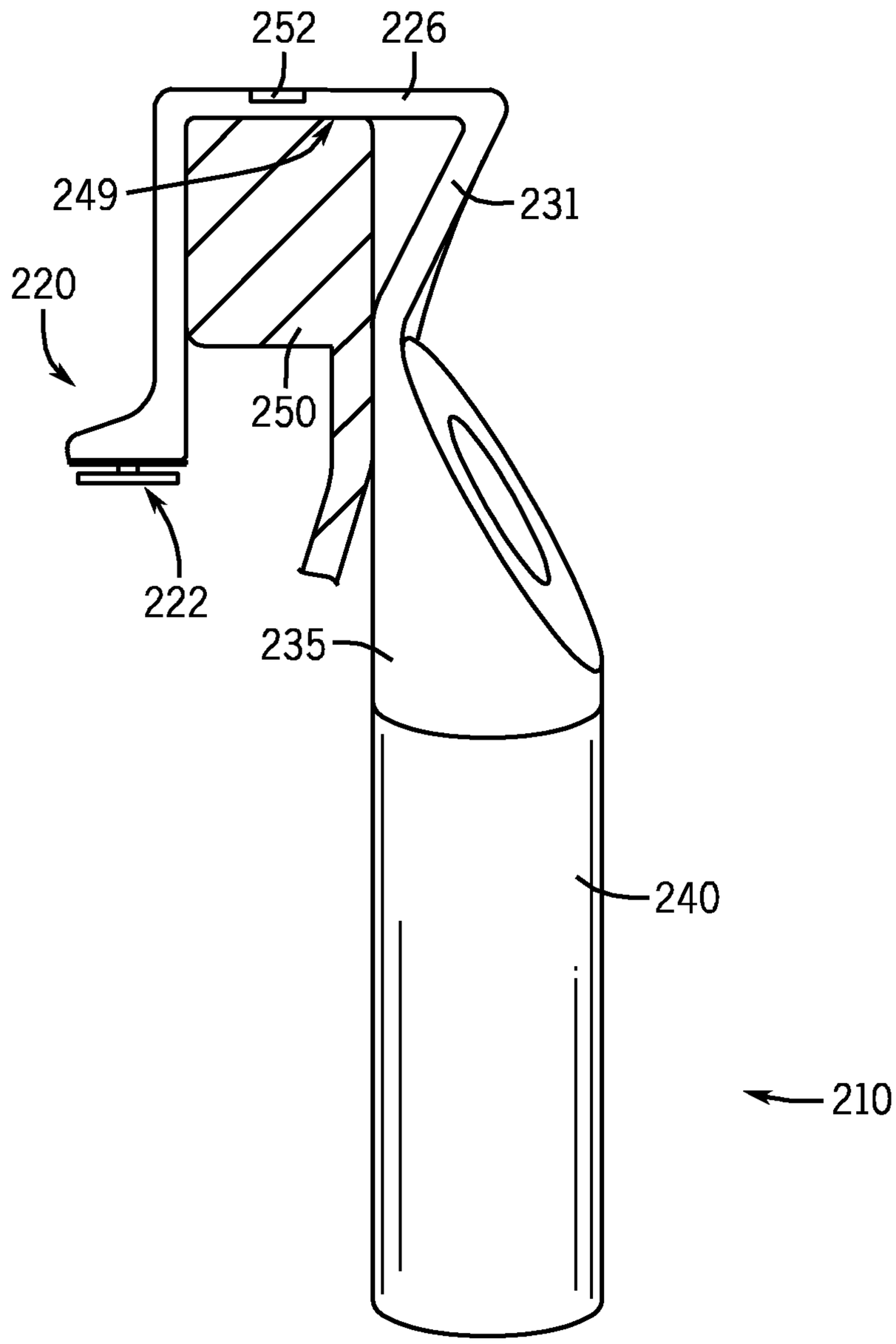

FIG. 5

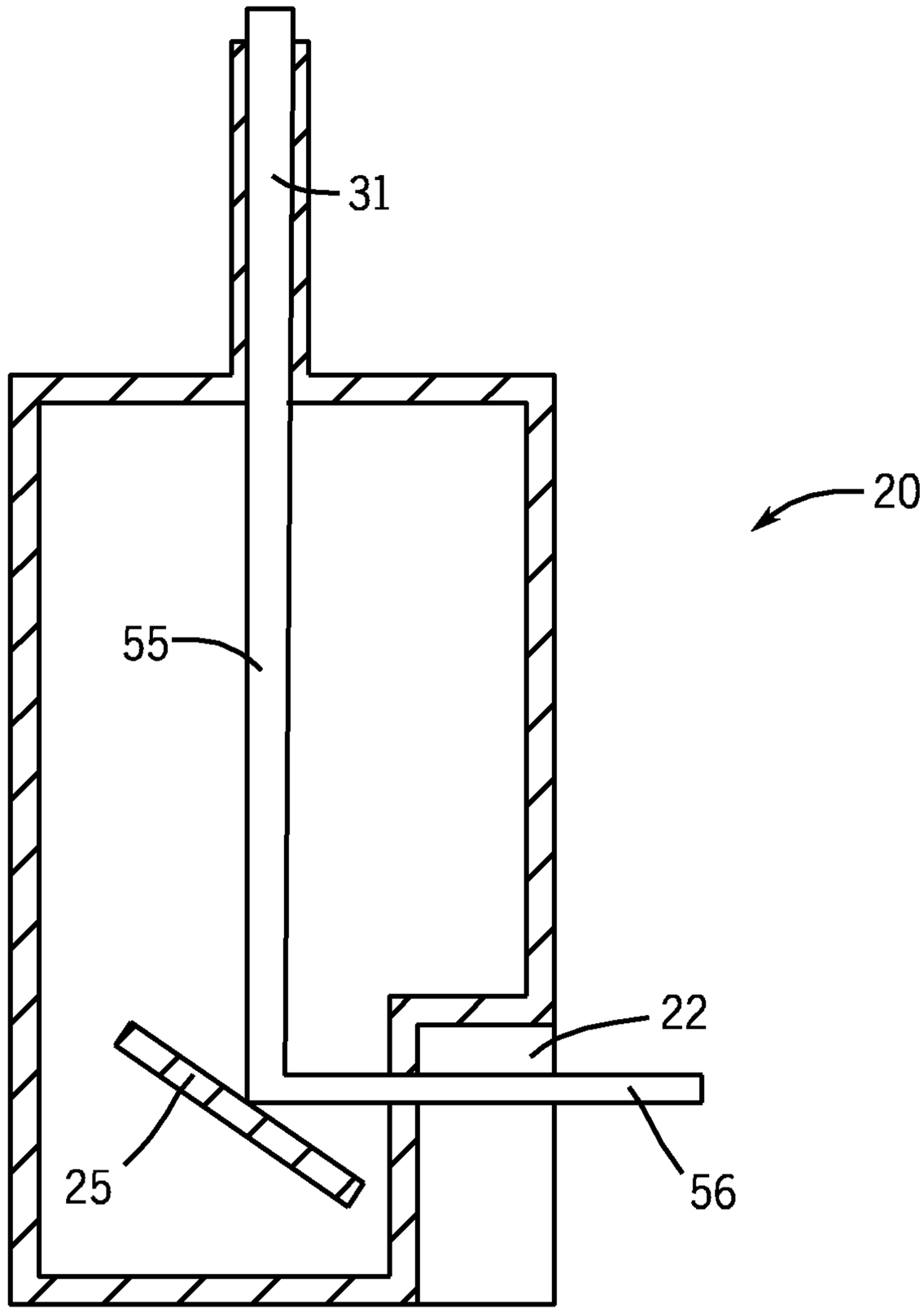

FIG. 6

FIG. 7

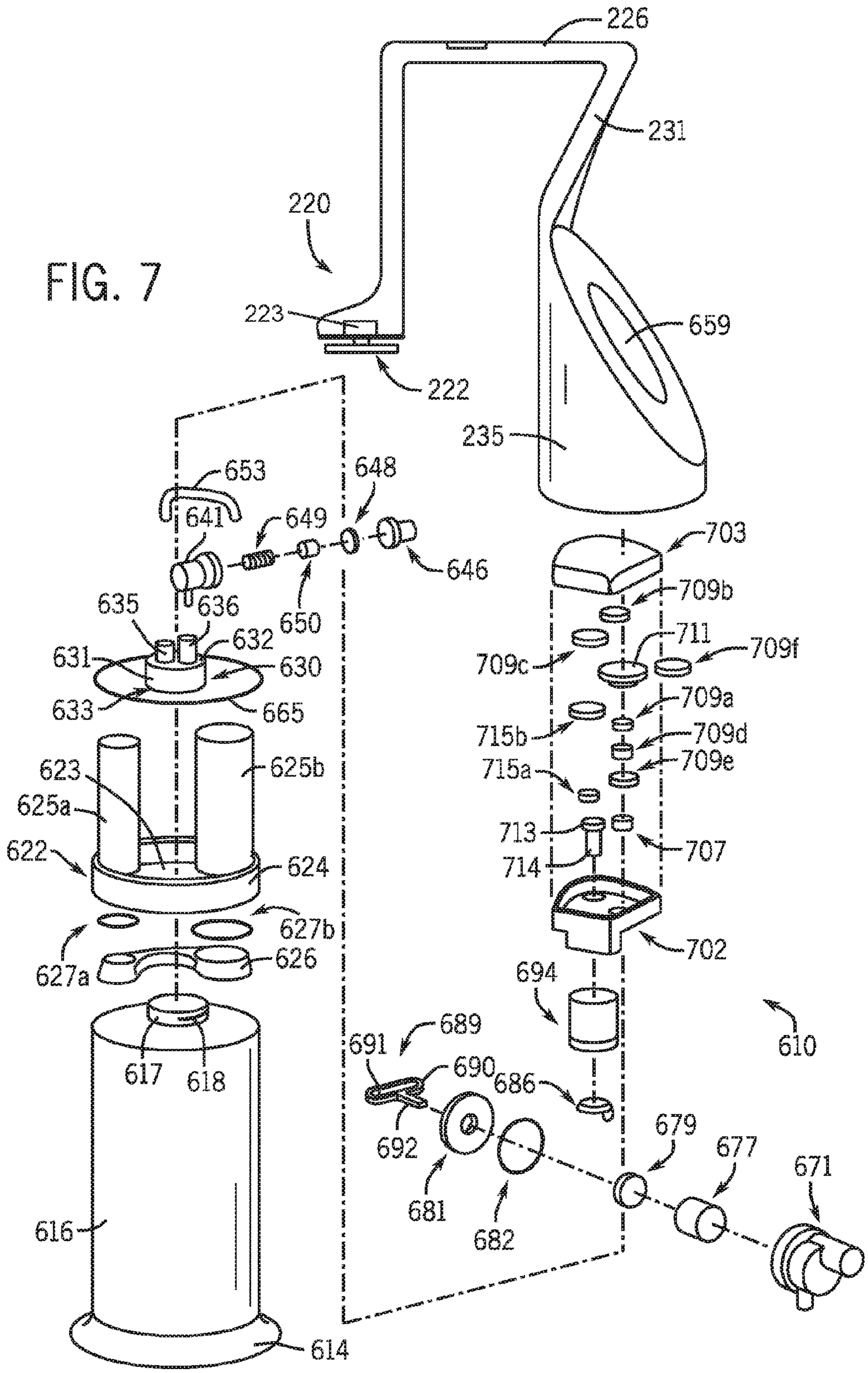
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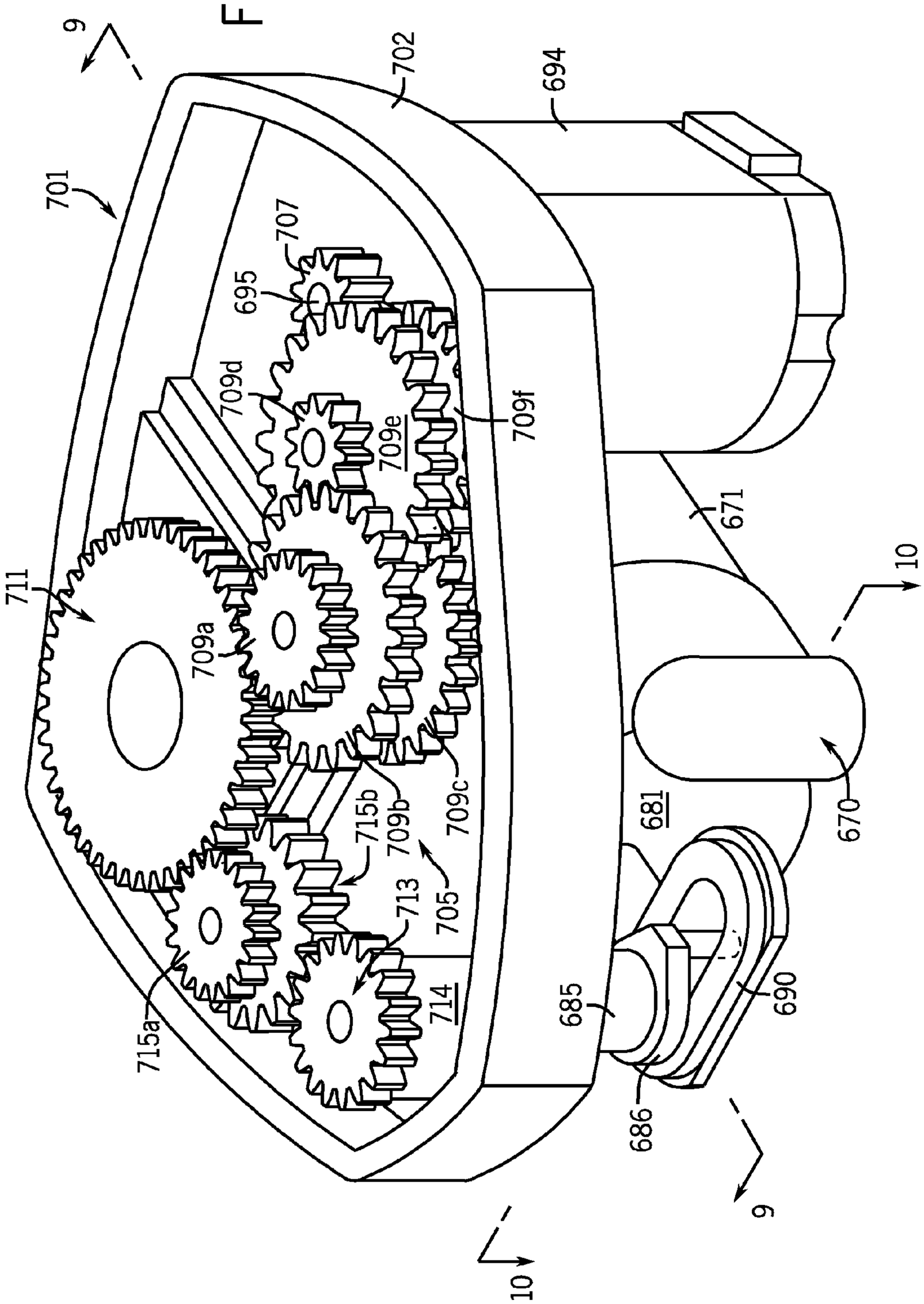
FIG. 8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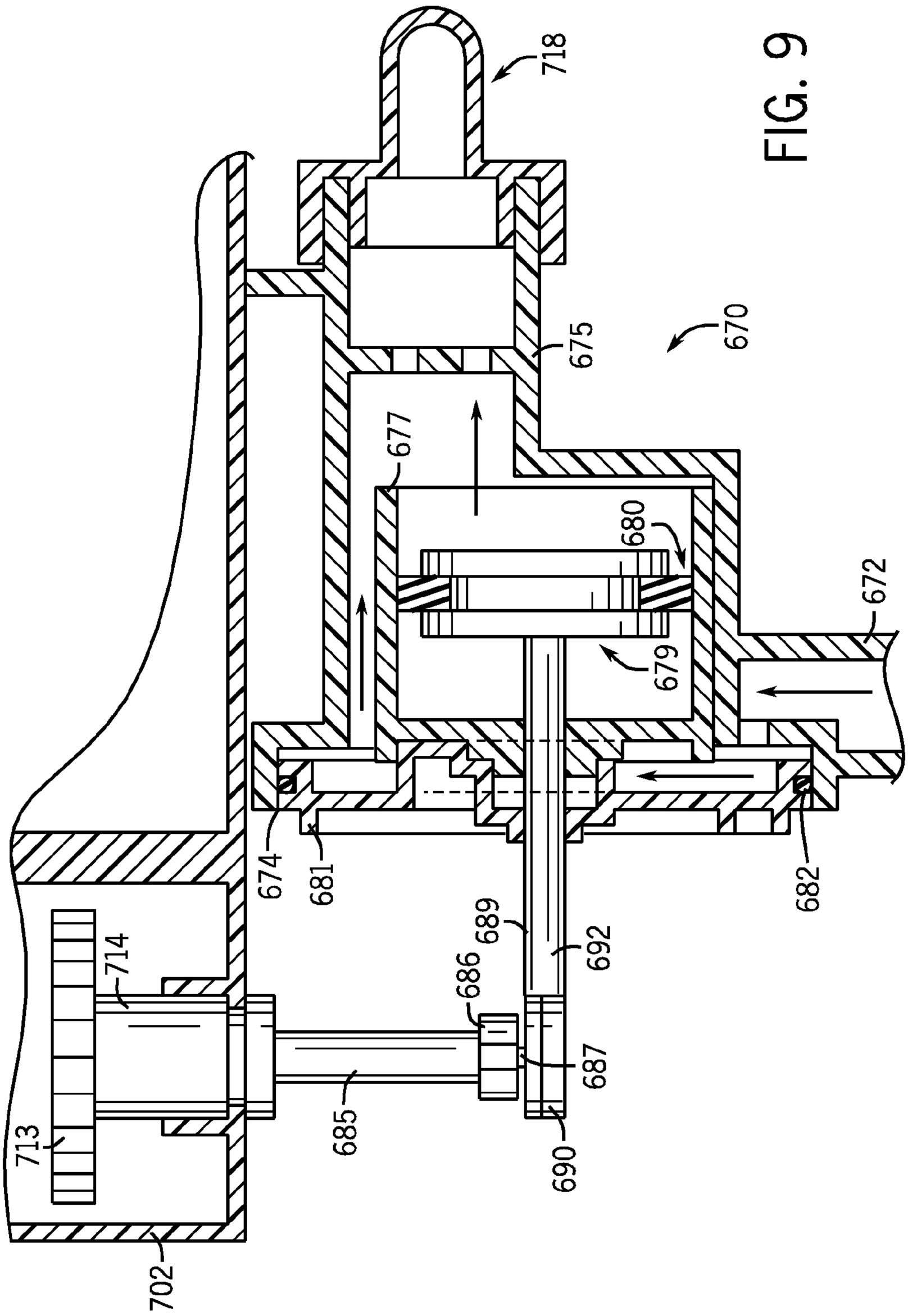
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FIG. 9

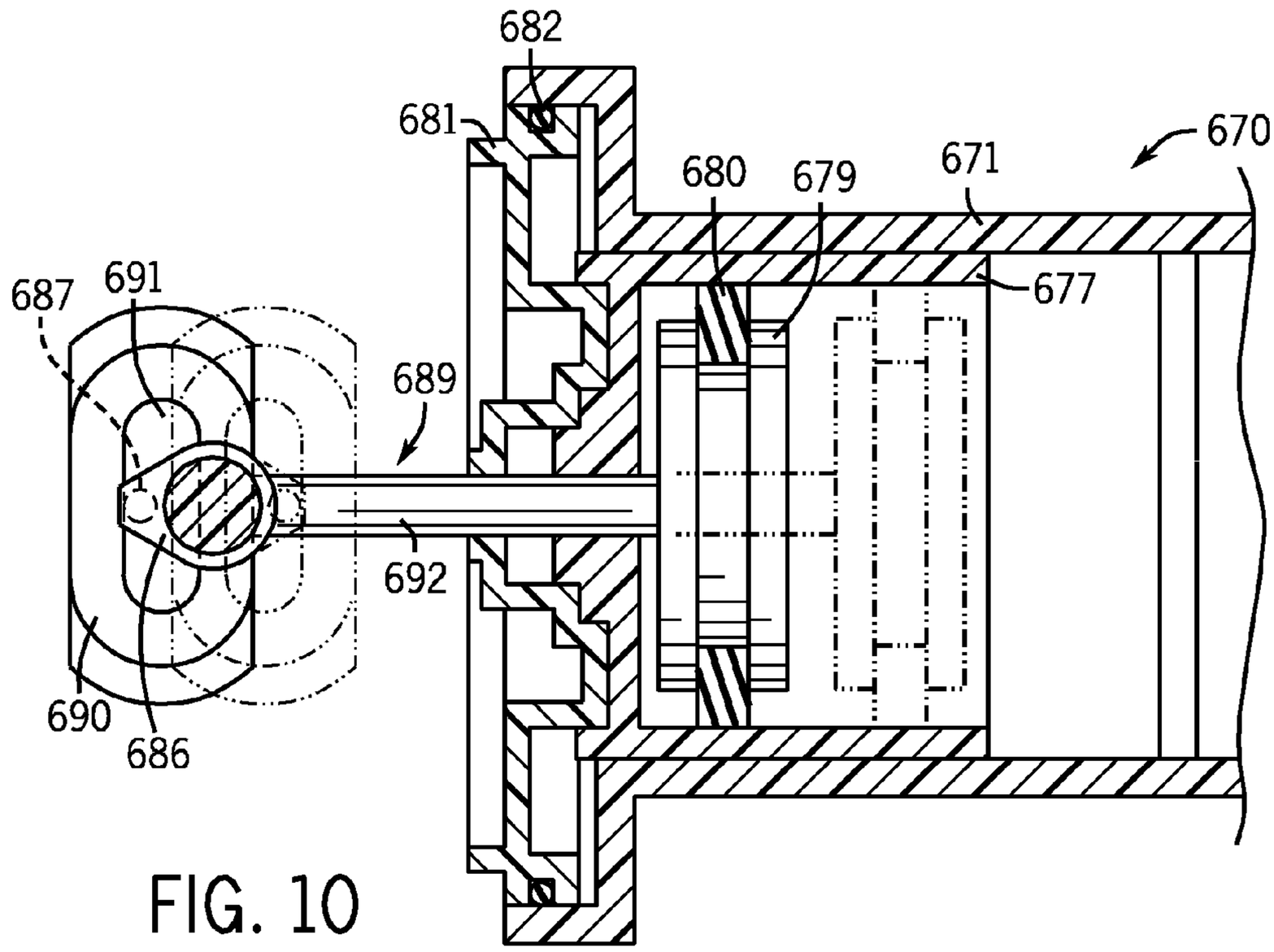
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FIG. 10

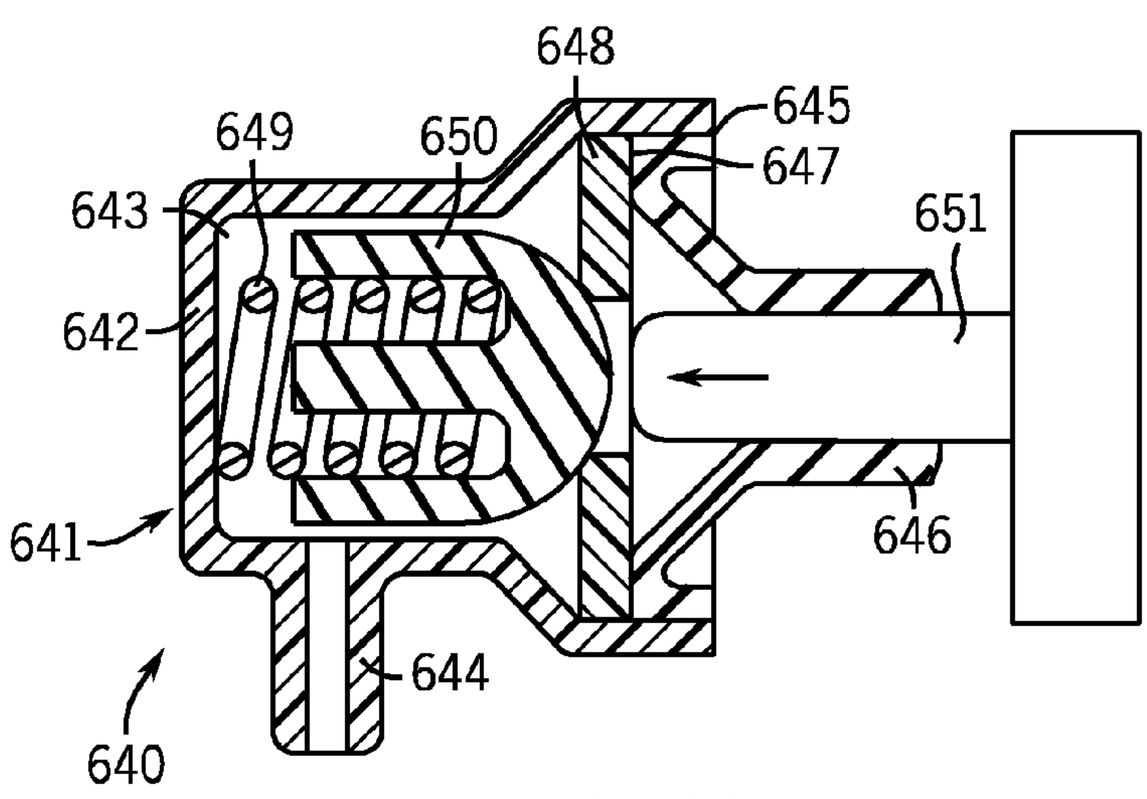
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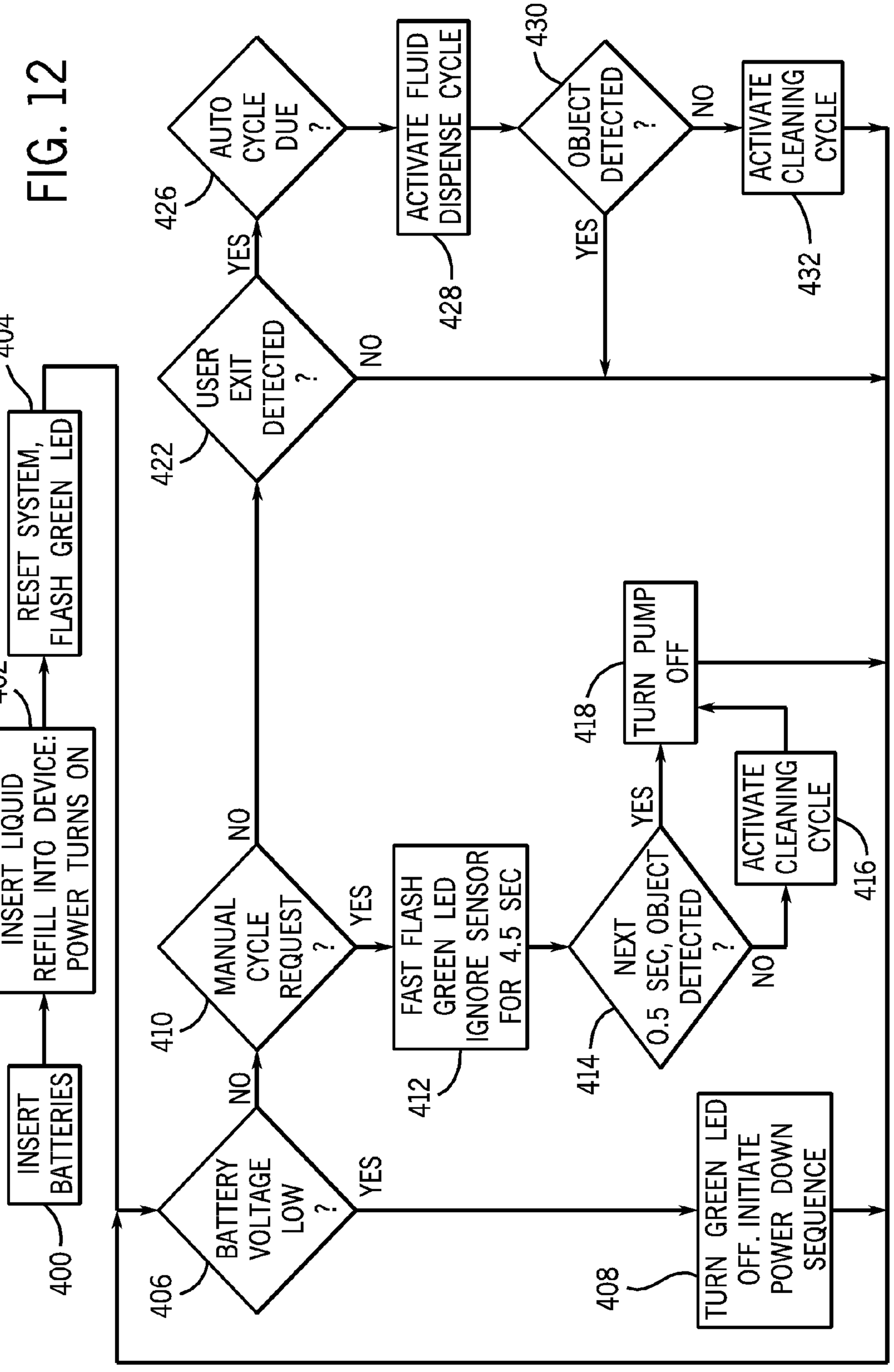
FIG. 11

FIG. 12


INSERT BATTERIES
400
BATTERY VOLTAGE LOW ?
406
YES
NO
TURN GREEN LED OFF. INITIATE POWER DOWN SEQUENCE
408
INSERT LIQUID REFILL INTO DEVICE: POWER TURNS ON
402
RESET SYSTEM, FLASH GREEN LED
404
MANUAL CYCLE REQUEST ?
410
YES
NO
FAST FLASH GREEN LED IGNORE SENSOR FOR 4.5 SEC
412
NEXT 0.5 SEC, OBJECT DETECTED ?
414
YES
NO
TURN PUMP OFF
418
ACTIVATE CLEANING CYCLE
416
USER EXIT DETECTED ?
422
YES
NO
AUTO CYCLE DUE ?
426
ACTIVATE FLUID DISPENSE CYCLE
428
OBJECT DETECTED ?
430
YES
NO
ACTIVATE CLEANING CYCLE
432

FLUID DISPENSER

CROSS-REFERENCES TO RELATED APPLICATIONS

This application is a divisional application of U.S. patent application Ser. No. 12/535,381 filed Aug. 4, 2009, which claims priority based on U.S. Provisional Application No. 61/087,543 filed Aug. 8, 2008.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH

Not Applicable.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to devices, systems and methods for dispensing, distributing or delivering a substance. More particularly, the invention relates to a device and method for dispensing a liquid (e.g., a cleaner, disinfectant, deodorizer, etc.). More particularly, the invention relates to dispensing a liquid in an enclosed area or defined perimeter, including in situations in which a human operator is present or not, and/or is not required or desired. In one embodiment, the invention is especially well suited for automatically cleaning toilet bowls of the type typically found in homes. In this embodiment, the invention relates to an automatic and/or manual toilet bowl cleaning device where the inner surface of the toilet bowl can be cleaned around the entire circumference of the toilet bowl. The device includes a nozzle that effectively delivers a cleaner around the circumference of a toilet bowl. The nozzle directs the flow of the cleaner.

2. Description of the Related Art

Toilet bowls require care to prevent the buildup of unsightly deposits, to reduce odors, and to prevent bacteria growth. Traditionally, toilet bowls have been cleaned, deodorized, and disinfected by manual scrubbing with a liquid or powdered cleaning and sanitizing agent. This task has required manual labor to keep the toilet bowl clean.

In order to eliminate the detested manual scrubbing, various toilet bowl cleaner dispensers have been proposed. One type of dispenser comprises a solid block or solid particles of a cleansing and freshening substance that is suspended from the rim of a toilet bowl in a container that is placed in the path of the flushing water. U.S. Pat. No. 4,777,670 shows an example of this type of toilet bowl cleaning system. Typically, a portion of the solid block is dissolved in the flush water with each flush, and the flush water having dissolved product is dispensed into the toilet bowl for cleaning the bowl.

Other toilet bowl cleaning systems use a liquid cleaning agent that is dispensed into a toilet bowl. For example, U.S. Pat. Nos. 6,178,564 and 6,230,334, and PCT International Publication Nos. WO 99/66139 and WO 99/66140 all disclose cleansing and/or freshening devices capable of being suspended from the rim of a toilet bowl for introducing liquid active substances from a bottle into the flushing water with each flush. In these under the toilet rim devices, the liquid active substances are delivered downward from a reservoir to a dispensing plate that is supported by a base that is suspended from the toilet bowl rim. The device is suspended from the toilet rim such that the flow of flush water from the toilet contacts the dispensing plate during a flush. The flush water carries the liquid active substances that are on the dispensing plate into the toilet bowl to clean and freshen the toilet.

Other toilet bowl dispensers use an aerosol deodorizing and/or cleaning agent that is dispensed into a toilet bowl through a conduit attached to the toilet bowl rim. For example, U.S. Pat. No. 3,178,070 discloses an aerosol container mounted by a bracket on a toilet rim with a tube extending over the rim; and U.S. Pat. Nos. 6,029,286 and 5,862,532 disclose dispensers for a toilet bowl including a pressurized reservoir of fluid, a conduit connected to the source of fluid, and a spray nozzle which is installed on the toilet rim.

One disadvantage with these known toilet rim dispensing devices is that these devices may only apply the deodorizing and/or cleaning agent to one location in the toilet water or a limited area in the toilet water or on the inner surface of the toilet bowl. As a result, the cleaning of the inner surface of the toilet bowl may be limited to an area of the toilet bowl near the device.

U.S. Patent Application Publication Nos. 2007/0136937, 2007/0234470, 2007/0240252, 2008/0017762, and 2009/0000016 (which are incorporated herein by reference) are owned by the owner of the current invention. These publications set forth, among others, an automatic and/or manual toilet bowl cleaning device where the inner surface of the toilet bowl is cleaned around the entire circumference of the toilet bowl.

In one example embodiment illustrated in U.S. 2007/0136937, the downstream end of a fluid supply conduit terminates in a nozzle capable of spraying the cleaning fluid outwardly onto the inner surface of the toilet bowl at locations below the toilet waterline, and/or locations at the toilet waterline, and/or locations above the toilet waterline, and/or locations under the toilet rim. The nozzle is attached by a mounting clip at a location near the rim of the toilet bowl. The mounting clip can house a proximity or motion sensor that detects the presence of a person. Manual delivery of the cleaning fluid from a fluid supply container to the fluid supply conduit can be achieved by pressing a manual activation button that is in electrical communication with a control circuit that turns on an electrically driven pump that delivers the cleaning fluid into the fluid supply conduit and into the spray nozzle. Automatic delivery of the cleaning fluid from a fluid supply container to the fluid supply conduit can also be achieved pressing an activation button that is in electrical communication with a control circuit that controls on an electrically driven pump. Immediately after the user presses the activation button, fluid delivery occurs at selected time intervals (e.g. every eight hours). The proximity sensor that is in electrical communication with the control circuit can stop initiation of a spray cycle if a person is near the toilet bowl.

In view of the advances in the art provided by the devices of U.S. Patent Application Publication Nos. 2007/0136937, 2007/0234470, 2007/0240252, 2008/0017762 and 2009/0000016 even further improvements to this technology would be beneficial to consumers.

SUMMARY OF THE INVENTION

The present invention meets the foregoing need for a device for spraying a fluid on an inner surface of a wall of an enclosure, such as a toilet bowl.

In one aspect, the invention provides a device for spraying an inner surface of a wall of an enclosure, such as a toilet with a fluid. The device includes a reservoir for the fluid, a

nozzle assembly through which the fluid can be sprayed on the inner surface of the wall of the enclosure, a fluid conduit in fluid communication with the reservoir and the nozzle, a pump for delivering fluid from the reservoir through the fluid conduit and to the nozzle when the pump assembly is activated, and a controller in electrical communication with the pump wherein the controller executes a stored program to activate and deactivate the pump. The nozzle assembly includes a nozzle which directs the fluid in a fluid path, and the nozzle assembly further includes one or more deflection shields that are dimensioned to contact and redirect fluid in the fluid path, and the nozzle assembly further includes mounting structure for attaching the nozzle near the inner surface of the wall of the enclosure. The flow off of the deflector shield is laminar. The controller can activate the pump when a manual actuator is actuated. In one form, the force of the fluid flowing into the nozzle assembly and out of the nozzle can effect rotation of the nozzle. The nozzle assembly can further include a motor to effect rotation of the nozzle. The fluid dispensed from the nozzle does not pass above a plane defined by a top surface of a toilet bowl of the toilet.

In another aspect of the invention, the invention provides a device for spraying an inner surface of a wall of an enclosure, such as a toilet bowl, with a fluid. The device includes a reservoir for the fluid, a nozzle assembly including a nozzle through which the fluid can be sprayed on the inner surface of the wall of the enclosure, a fluid conduit in fluid communication with the reservoir and the nozzle, a pump for delivering fluid from the reservoir through the fluid conduit and to the nozzle when the pump is activated, and a controller in electrical communication with the pump, the controller executing a stored program to activate and deactivate the pump, and a vent assembly in fluid communication with an interior space of the reservoir. The nozzle assembly includes mounting structure for attaching the nozzle near the inner surface of the wall of the enclosure. The vent assembly includes a valve wherein the valve opens by negative pressure that develops as fluid is withdrawn from the reservoir and closes when the pressure in the reservoir has equalized. The valve can be an actuator assist valve. The controller can activate the pump based on a scheduled spraying time stored in the controller. The controller can activate the pump when a manual actuator is actuated. In one form, fluid flowing into the nozzle assembly and out of the nozzle effects rotation of the nozzle. The nozzle assembly can further include a motor to effect rotation of the nozzle.

In yet another aspect of the invention, the invention provides a device for spraying an inner surface of a wall of a toilet bowl with a fluid. The device includes a reservoir for the fluid, a nozzle assembly including a nozzle through which the fluid can be sprayed on the inner surface of the wall of the toilet bowl, a fluid conduit in fluid communication with the reservoir and the nozzle, a pump for delivering fluid from the container through the fluid conduit and to the nozzle when the pump is activated, a sensor for detecting unseating of a person from the toilet, and a controller in electrical communication with the pump, the sensor, and a source of electricity. The nozzle assembly includes mounting structure for attaching the nozzle near the inner surface of the wall of the toilet bowl. The controller executes a stored program to (i) monitor electrical signals from the sensor to determine when a person unseats from the toilet, and (ii) if the controller determines that a person has unseated from the toilet, activate the pump for a pump cycle time for delivering fluid from the reservoir through the fluid conduit and to the nozzle. The sensor can be an infrared sensor that emits an actuation signal upon a predetermined change in light intensity. The sensor can be a pressure sensor disposed on the nozzle assembly that senses the force of a person seated on the toilet. The controller can activate the pump when a manual actuator is actuated. In one form, the force of the fluid flowing into the nozzle assembly and out of the nozzle can effect rotation of the nozzle. The nozzle assembly can include a motor to effect rotation of the nozzle.

In still another aspect of the invention, the invention provides a device for spraying an inner surface of a toilet bowl with a fluid. The device includes a reservoir for the fluid, a nozzle assembly including a nozzle through which the fluid can be sprayed on the inner surface of the toilet bowl, a pump for delivering fluid from the reservoir through the fluid conduit and to the nozzle when the pump is activated, and a controller in electrical communication with the pump. The controller executes a stored program to activate and deactivate the pump. The nozzle assembly includes mounting structure for attaching the nozzle near the inner surface of the toilet bowl. The nozzle assembly further includes a housing connected to the mounting structure, and the housing contains the pump and the controller. The controller can activate the pump based on a scheduled spraying time stored in the controller. The controller can activate the pump when a manual actuator is actuated. In one form, the force of the fluid flowing into the nozzle assembly and out of the nozzle can effect rotation of the nozzle.

The advantages of the present invention will become apparent from the following description. In that description reference will be made to the accompanying drawings which form a part thereof, and in which there is shown by way of illustration example embodiments of the invention. The example embodiments do not limit the full scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic view of an automated sprayer assembly in accordance with a non-limiting embodiment of the present invention.

FIG. **2** is a front right perspective view of another embodiment of an automated sprayer assembly in accordance with the present invention.

FIG. **3** is a front view of the sprayer assembly of FIG. **2**.

FIG. **4** is a rear perspective view of the sprayer assembly of FIG. **2**.

FIG. **5** is a perspective view of another embodiment of an automated sprayer assembly in accordance with the present invention.

FIG. **6** is a cross-sectional view of a nozzle assembly for use with the automated sprayer assembly of FIGS. **2-4**.

FIG. **7** is an exploded perspective view of another automated sprayer according to the invention.

FIG. **8** is a perspective view of the motor, pump, and gear box assembly (with the upper gear case section removed) of the automated sprayer of FIG. **7**.

FIG. **9** is a cross-sectional view taken along line **9-9** of FIG. **8**.

FIG. **10** is a cross-sectional view taken along line **10-10** of FIG. **8**.

FIG. **11** is a cross-sectional view of an air vent valve suitable for use with an automated sprayer in accordance with the invention.

FIG. **12** is a functional flow diagram of the steps in an example operating method for the toilet bowl cleaning device of FIG. **8**.

Like reference numerals will be used to refer to like parts from Figure to Figure in the following detailed description.

DETAILED DESCRIPTION OF THE INVENTION

FIG. **1** is a schematic view of an exemplary automated sprayer assembly. As illustrated, in some embodiments, automated sprayer assembly **10** may include a nozzle assembly **20**, a pump assembly **30**, and a fluid reservoir **40**. Generally, a portion of the automated sprayer assembly **10**, such as for example the nozzle assembly **20**, or nozzle assembly **20** and pump assembly **30**, may be provided with a mounting structure such that that the portion of the automated sprayer assembly **10** may be mounted in an enclosure and/or partial enclosure, such as for example a toilet bowl, and actuated to initiate dispensing an amount of fluid from the nozzle assembly **20**.

In some embodiments, nozzle assembly **20** may include a nozzle **22**, actuating sensor **24**, and a mounting structure **26**. Generally, nozzle assembly **20** may be sized and shaped such that it may be fixedly mounted, via mounting structure **26**, within the interior of a toilet bowl, such as for example directly below the top rim of a toilet bowl. An exemplary design is described in U.S. Des. Pat. No. D591,824. In one embodiment, nozzle assembly **20** may be configured such that when mounted, fluid dispensed from nozzle **22** may cover substantially the entire interior toilet bowl wall. In this regard, nozzle **22** may be configured on the nozzle assembly **20** such that the force of fluid flowing into the nozzle assembly **20** and out of nozzle **20** effects rotation of the nozzle **22**. Alternatively, rotation of nozzle **22** may be motor driven. In a further alternative, nozzle **22** may be stationary, and configured to deliver a spray pattern that covers substantially the entire interior toilet bowl wall.

In one embodiment, nozzle **22** may be further configured to prevent fluid dispensed from nozzle **22** to pass above a plane defined by the top surface of the toilet bowl. Such controlled delivery may be achieved, for example, appropriate configuration of the spray pattern of nozzle **22** and/or by the addition of a deflector shield **25** (see FIG. **6**). Surprisingly, it is discovered that the use of a deflector shield **25** (see FIG. **6**) provides the benefit of a laminar flow exiting the nozzle **22**. In some embodiments, nozzle **22** may be any type of nozzle suitable for controlled delivery of fluid, such as for example, a fan nozzle.

Nozzle assembly **20** may further include an actuation sensor **24**. Generally, actuation sensor **24** may comprise any sensing device that accommodates selective actuation of the automated sprayer assembly **10**. For example, in one embodiment, actuation sensor **24** comprises an infrared (IR) sensor. As is known, IR sensors may emit an actuation signal upon a predetermined change in light intensity, such as that which may occur in a toilet bowl when an individual seats/unseats themselves on/from a toilet. As a further example, sensor **24** may comprise a pressure sensor disposed on nozzle assembly **20** such that it may sense the force of an individual seated on the toilet. Alternatively, any type of suitable sensor may be employed.

In some embodiments, pump assembly **30** may be coupled to the nozzle assembly **20** such that both of the nozzle assembly **20** and pump assembly **30** are positioned within the toilet bowl. Alternatively, pump assembly **30** may be coupled to fluid reservoir **40** such that the pump assembly **30** and the fluid reservoir **40** comprise a unitary structure. In a further alternative, pump assembly **30** may be a stand-alone structure.

Pump assembly **30** may include a pump **32**, motor **34**, power source **36**, vent system **38**, and control circuitry **39**. To accommodate fluid flow between the components of the automated sprayer assembly **10**, in some embodiments, pump assembly **30** may further include one or more fluid pathways. For example, pump assembly **30** may include a first fluid pathway **31** providing fluid communication between the nozzle **22** and an outlet of pump **32**, a second fluid pathway **33** providing fluid communication between reservoir **40** and an inlet of pump **32**, and third fluid pathway **35** providing fluid communication between the vent system **38** and fluid reservoir **40**.

Pump **32** may be any conventional pump, such as for example, a piston pump, gear pump, peristaltic pump, a dual reciprocating pump and the like. In one embodiment, components of a gear box assembly, driven by motor **34**, may operate to drive the pump **32**. Generally, operation of the pump **32** draws fluid from the fluid reservoir **40** via pathway **33** and to the nozzle assembly **20** via pathway **31**. Alternatively, some embodiments of the present invention device **10** do not have a pump **32**. In such embodiments, it may be desirable to provide a pressuring fluid reservoir **40** instead.

Motor **34** may comprise a direct current motor. Alternatively, any suitable motor for driving pump **32** may be employed. In one embodiment, motor **34** may include a rotating drive shaft that is operably coupled to one or more components of a gear box assembly, the gear box assembly being coupled to the pump **32** such that operation of the motor **34** drives pump **32**, which draws fluid from the reservoir **40** and to the nozzle assembly **20**. Alternatively, any suitable linkage may be provided between the pump **32** and motor **34**.

In some embodiments, vent system **38** may comprise a valve configured such that it opens by negative pressure that develops as fluid is withdrawn from the reservoir **40**, and closes when the pressure in the reservoir has equalized sufficiently to alleviate any negative pressure. In some embodiments, vent system may comprise an actuator assist valve. Alternatively, any other type of valve suitable for aspiration of air into the reservoir may be used, such as for example, a check-ball valve, duckbill valve, and the like.

In certain embodiments, control circuitry **39** may be accommodated in pump assembly **30**. Control circuitry **39** may comprise an integrated circuit board and any or all of a speaker, LED, and an actuation switch coupled to, for example, a push button actuator. Control circuitry **39** may be in electronic communication with the motor **34** and actuation sensor **24**. The control circuitry **39** may be further electrically coupled to the power supply via, for example, battery terminals in the battery compartments.

In one embodiment, control circuitry **39** may comprise timing circuitry to, for example, delay activation of the automated sprayer assembly **10**. In other embodiments, timed release actuation or actuation at a set or selected time may be provided by a suitable programmed or programmable timer or time release device and/or, in some embodiments, actuation may be controlled remotely.

In one embodiment, power source **36** may comprise a DC power supply, such as for example, one or more batteries stored in one or more battery compartments. In one embodiment, the battery compartments comprise isolated or separate battery compartments, that are spaced away from and generally downwardly from the pump **32** and motor **34**. The battery compartments may be accessible from an exterior of the pump assembly **30** and include a removable battery cover which facilitates user access the battery compartment.

In one embodiment, power supply may comprise battery two AA batteries. Alternatively, any number of batteries of any type may be employed.

In some embodiments, fluid reservoir **40** may be positioned in a location which is remote relative to the nozzle assembly **20**, or remote relative to both of the nozzle assembly **20** and the pump assembly **30**. In one embodiment, fluid reservoir **40** may include a mounting structure which facilitates mounting of the fluid reservoir to an exterior of the toilet bowl and/or toilet tank. Alternatively, the fluid reservoir **40** may be configured such that it may stand on a surface immediately surrounding the toilet, such as on a bathroom floor.

In some embodiments, when a user wishes to spray the interior toilet bowl walls with cleansing fluid, the user may simply depress the push button actuation switch at the front of the sprayer **10**. This may signal timing circuitry to begin a countdown delaying spraying for a predetermined time. This affords the user time to unseat themselves from the toilet before actuation of the motor **32**. Initially depressing the switch may also send a pulsed tone to the speaker and flash the LED for warning the user of the impending operation of the sprayer.

In other embodiments, the sprayer **10** may be automatically actuated upon receiving an actuation signal from actuation sensor **24**. For example, when a user unseats themselves from the toilet, or upon the detection of a flush, or some other signal that indicates the user has completed use of the toilet, the actuation sensor may send a signal to the control circuitry **39**. This may signal timing circuitry to begin a countdown delaying spraying for a predetermined time. Additionally, this may send a pulsed tone to the speaker and flash the LED for warning the user of the impending operation of the sprayer.

In some embodiments, unless cancelled by the user, the spray cycle may begin automatically at the expiration of the countdown. The motor **34** is then energized which simultaneously drives components of the pump such that the pump draws fluid from the fluid reservoir **40** through the pathway **31**. This reduces the level of cleanser in the bottle, creating a negative pressure in the bottle, which opens the vent system **38** to aspirate the fluid reservoir **40** and allow more fluid to be drawn from the fluid reservoir **40** during the spray cycle.

The motor may continue to be energized until the expiration of a second countdown performed by the timing circuit, automatically initiated by the timer. At that point the motor is deenergized which shuts down the pump **32**.

FIGS. **2-4** illustrate an alternative automated fluid sprayer **110** according to some embodiments. As illustrated, automated fluid sprayer **110** may include a nozzle assembly **120**, a pump assembly **130**, and a fluid reservoir **140**. Nozzle assembly **120** may include may include a rotating nozzle **122** and a mounting structure **126**. Nozzle assembly **120** may include may a pivot pin **124** for pivoting the rotating nozzle **122** in directions R in FIG. **2**. As shown, nozzle assembly **120** may be configured such that it may be fixedly mounted, via mounting structure **126**, on the upper rim of a toilet bowl such that the nozzle **122** is within the interior of the toilet bowl. Nozzle assembly **120** may be in fluid communication with the pump assembly **130** via fluid pathway **131**.

Pump assembly **130** may be coupled to fluid reservoir **140** such that the pump assembly **130** and the fluid reservoir **140** comprise a unitary structure. In some embodiments, the unitary structure may be mounted via mounting structures **150** to a toilet bowl and/or toilet tank (not shown). Alternatively, the unitary structure may include a removable floor stand **160** for facilitating placement of the unitary structure on the floor immediately adjacent the toilet.

FIG. **5** shows another alternative automated fluid sprayer **210** according to some embodiments. As illustrated, automated fluid sprayer **210** may include a nozzle assembly **220**, a pump assembly in a housing **235**, and a fluid reservoir **240**. Nozzle assembly **220** may include may include a rotating nozzle **222** and a mounting structure **226**. As shown, nozzle assembly **220** may be configured such that it may be fixedly mounted, via mounting structure **226**, on the upper rim **249** of a toilet bowl **250** such that the nozzle **222** is within the interior of the toilet bowl **250**. Nozzle assembly **220** may be in fluid communication with the pump assembly via fluid pathway **231**. The housing **235** may be coupled to fluid reservoir **240** such that the housing **235** and the fluid reservoir **140** comprise a unitary structure. The unitary structure may be mounted via mounting structure **226** to toilet bowl **250** and/or a toilet tank (not shown). Mounting structure **126** of FIGS. **2-4** is also mounted over a toilet bowl **250** in a similar manner as mounting structure **226**. The top of the mounting structure **226** can include a pressure sensor **252** that senses when a user is sitting on a toilet seat and when a user has unseated from the toilet seat.

Use of a Deflector Shield

In certain non-limiting embodiments of the present invention, the present invention spray device provides a spray pattern using a deflector shield or other deflector surface to directing liquid/fluid from the device. FIG. **6** shows an exemplary embodiment of a nozzle assembly **20**. The nozzle assembly **20** comprises a deflector shield **25** that may direct fluid **55** that is provided from the first fluid pathway **31** to the nozzle assembly **20** in one or more directions through the nozzle **20** in a coherent, laminar flow **56** and towards the inner surface of a toilet bowl (not shown) or other enclosure (not shown).

Without wishing to be limited by theory, it is thought that there is a resultant laminar fluid flow from the deflector shield **25** that may be directed towards the inner surface of an enclosure. It is thought that the direction of laminar flow, towards the inner surface of the enclosure, as compared to the mere expulsion of fluid from an orifice, provides a resultant spray having particles that are not extremely fine particles. It is surprisingly discovered by the inventors that a dispersion of relatively fine particles is not well suited for automatic toilet cleaning purposes because such particles are often subject to undesirable drifting, and such fine particles, which may be acceptable for the delivery of fragrance, are relatively unsuitable for delivering cleanser composition to the inner surface of an enclosure (such as a toilet bowl).

Further, it is thought that by directing a turbulent stream towards an enclosure, the resultant contact between the turbulent stream and the surface of the enclosure may create a splash which may cause additional considerations for producers/manufacturers as opposed to a laminar flow which provides a relatively low amount of splash.

In another embodiment, a plurality of the deflector shields **25** can also be arranged with their axis parallel to the central longitudinal axis of the first fluid pathway **31**. This arrangement or structure also provides for a coherent or laminar flow for the reduction of turbulence, and any turbulence reducing structure or method may be adapted to provide for a coherent or laminar flow or stream from the nozzle assembly **20**, including, for example, star-shaped chambers, stacks or bundles of materials, foam plugs, shaped chambers or chamber walls. Creating a coherent or laminar stream also

makes it possible to extend the distance through which the fluid or liquid can effectively and efficiently be delivered.

Use of a Motor

There exist particular systems wherein the rotation of the nozzle may be caused by the flow of fluid. A non-limiting example of such a system is described in U.S. Pat. No. 5,024,382. Such a system is noted to be well-suited for high-pressure spray applications. In such a system, the rate of rotation appears to be highly correlated to the flow rate and other flow characteristics. By comparison in a system wherein the spray and delivery of the fluid and/or composition is relatively critical, it is discovered that it may be desirable to control any rotational characteristics of the spray nozzle in order to control the level of deposition/amount of product or composition that is deposited onto the surface of the enclosure. This may be of particular importance to a device that provides a cleaning composition to the inner surface of an enclosure such as a toilet bowl because there may be an optimal amount of coverage that is needed for effective cleansing.

A suitable motor may be used to provide rotation to the nozzle assembly. A suitable means may be used to control the rate of rotation, such of the nozzle assembly.

User Detection

In some embodiments, the present invention may include one or more sensors to detect the presence of a user. Certain freshening systems for use in lavatories detect the presence of a user as a trigger to dispense freshening composition or fragrance, etc. An exemplary system is the Sense N' Spray device that is produced by the S.C. Johnson & Son, Co. (Racine, Wis.). It is discovered that such a system may not be best suited for the present invention automatic toilet cleaning device because the process of actively dispensing a composition in the presence of a user is actually undesirable in the present invention system because it may not be desired to spray the user with composition and/or fragrance.

The present invention addresses this unexpected obstacle by providing an exemplary embodiment wherein the embodiment comprises a sensor system that provides feedback to a control unit in the present invention device such that the device does not discharge any composition when a user is detected to be nearby, or in some other embodiments, seated on or otherwise engaged with, the toilet bowl.

A sensor for preventing accidental or unwanted discharge of fluid or composition from the device may be selected from proximity sensors, light sensors, sound sensors, pressure sensors, vibration sensors, motion sensors, and combinations thereof. In one version of the invention, the means for delivering fluid from the container is a pump, and the device further includes a control system in electrical communication with the pump and the sensor and a source of electricity, wherein the control system executes a stored program to initiate a cycle in which the pump delivers fluid from the container through the fluid conduit and to the fluid delivery device. The enclosure can be a toilet bowl, the sensor can be a flush sensor, and the control circuit can execute the stored program to initiate the cycle after the flush sensor senses a flush. The control circuit can include a timer circuit which automatically initiates the cycle at a set time period after the flush.

Looking at FIGS. **7-11**, there is shown an example embodiment of another automated sprayer **610** according to the invention. The sprayer **610** is especially well suited for supplying a liquid to the fluid pathway **231** of the sprayer **610**.

Referring to FIG. **7**, the sprayer **610** includes a bottle **616** having a hollow neck **617** with external threads **618** and a removable floor stand **614**. The bottle **616** is suitable for containing a liquid for cleaning and/or freshening and/or disinfecting a hard surface such as a wall of a toilet bowl. The bottle **616** may be supplied with a closure (not shown) that is screwed onto the neck **617**. The closure keeps the liquid contained in the bottle **616** before the bottle **616** is installed in the sprayer **610**. The bottle **616** is typically formed from a suitable polymeric material such as polyethylene, polypropylene, or polyethylene terephthalate. The threads may be either the so-called "conventional" threads or the so-called "bayonet"-type threads.

Looking at FIG. **7**, the sprayer **610** includes a lower housing section **622** with a bottom wall **623** and an outer wall **624** that extends upward from the bottom wall **623**. The lower housing section **622** includes upwardly extending hollow battery compartments **625***a*, **625***b* for containing batteries as an energy source for the sprayer **610**. Any number of batteries of any type may be employed. A removable cover **626** provides access to the battery compartments **625***a*, **625***b* so that a user can replace discharged batteries. The cover **626** can be secured to the bottom wall **623** of the lower housing section **622** by a suitable fastener such as a screw, and O-rings **627***a*, **627***b* provide a watertight seal between the cover **626** and the bottom wall **623** of the lower housing section **622**. The lower housing section **622** can be formed from a polymeric material such as polyethylene or polypropylene. Looking at FIG. **7**, the sprayer **610** also includes an upper housing section **235** (also shown in FIG. **5**) which can be formed from a polymeric material such as polyethylene or polypropylene. The upper housing section **235** mates with the lower housing section **622**.

The sprayer **610** also includes a bottle coupler **630** having an outer wall **631**, and a top wall **632**, and an open end **633** opposite the top wall **632**. The outer wall **631** and the top wall **632** define a generally cylindrical interior space in the bottle coupler **630**. The bottle coupler **630** includes a first tubular conduit **635** and a second tubular conduit **636**. The first tubular conduit **635** defines a liquid passageway in fluid communication with the interior space in the bottle coupler **630**. The second conduit **636** defines an air vent passageway in fluid communication with the interior space in the bottle coupler **630**. The bottle coupler **630** is mounted in a hole in the bottom wall **623** of the lower housing section **622**. The inner surface of the outer wall **631** of the bottle coupler **630** includes threads that are dimensioned to matingly engage the external threads **618** on the neck **617** of the bottle **616** when the neck **617** of the bottle **616** is screwed into the interior space in the bottle coupler **630**. Optionally, the bottle coupler **630** mates with a dip tube that is provided in the bottle **616**.

Referring now to FIGS. **7** and **11**, the sprayer **610** also includes an actuator assist check valve **640** that provides for venting of the bottle **616** from the atmosphere. Air replaces the volume of liquid drawn into the pump of the sprayer, and prevents the bottle **616** from collapsing. The check valve **640** includes a valve housing **641** having an outer wall **642** that defines an interior space **643** of the check valve **640**. A first conduit **644** provides an air flow path into the interior space **643**. The check valve **640** has an open end **645**, and has a second conduit **646** with a generally funnel shaped end that is press fit into the open end **645**. An annular valve seat **647** is provided on the funnel shaped end of the second conduit **646**. The check valve **640** includes a flexible annular valve seal **648** that seats against the annular valve seat **647** when the check valve **640** is in the normally closed position shown in FIG. **11**. The check valve **640** includes a helical compression spring **649** that biases an umbrella shaped

valve element **650** against the valve seal **648** to keep the valve seal **648** in the normally closed position. In an example form of the check valve **640**, the valve seal **648** can be formed from an elastomeric material, the spring can be formed from carbon or stainless steel, and the remaining components of the check valve **640** can be formed from a polymeric material such as polyethylene or polypropylene.

The first conduit **644** of the check valve **640** can be press fit into the second conduit **636** of the bottle coupler **630** such that the first conduit **644** is placed in fluid communication with the interior space in the bottle coupler **630** and the bottle **616** which is mounted to the bottle coupler **630**. Negative pressure can build in the bottle **616** when liquid is withdrawn from the bottle **616**. The negative pressure overcomes the biasing force of the spring **649** and/or the sealing force of the annular valve seal **648** against the annular valve seat **647** such that atmospheric air flows between the annular valve seal **648** and the annular valve seat **647**, into the interior space **643** of the check valve **640**, through the first conduit **644**, into the interior space in the bottle coupler **630** and into the bottle **616** to provide venting.

In some cases, the fluid used in the bottle **616** may leave a sticky residue on the umbrella shaped valve element **650**, thereby causing inconsistency in valve operation, and preventing correct air flow into the bottle **616**. For example, the sticky residue may cause the umbrella shaped valve element **650** to stick in an open position and allow leaks and/or stick in a closed position such that fluid or air is prevented from passing through. The sticky residue may be caused, for example, by direct contact between the umbrella shaped valve element **650** and fluid from the bottle **616** that has seeped up into the valve **640** or by contact with vapors from the fluid in the reservoir.

The valve **640** may further include a mechanical actuator, such as a mechanical tab, rod, or lever, etc., that may open or initiate the opening of the valve **640**. Once the opening of the valve **640** has been initiated using the mechanical actuator, the vacuum created by the reservoir may maintain the valve **640** in an open position, or continue opening the valve **640**, such that air may flow from the second conduit **646** to the first conduit **644**. The mechanical actuator, in one embodiment, may be a push rod **651** (see FIG. **11**) generally near the second conduit **646**. The push rod **651** may have a normal position with one end protruding from the second conduit **646** of the valve **640**. In one embodiment, the push rod **651** may be activated by a solenoid of the sprayer **610**. Upon actuation of the solenoid, the push rod **651** contacts the umbrella shaped valve element **650**. Contact between the push rod **651** and the umbrella shaped valve element **650** may unseat, or initiate the unseating of, the umbrella shaped valve element **650** from the valve seat **647**. The resulting vacuum created in the bottle **616** may cause the umbrella shaped valve element **650** to remain unseated or continue to become unseated from the valve seat **647**, thereby opening the valve **640**.

Referring now to FIGS. **7**, **9** and **10**, the sprayer **610** also includes a pump **670**. While the illustrated pump **670** is a piston pump, other types of pump such as diaphragm pump, a peristaltic pump, or a gear pump can be used in the sprayer **610**. The pump **670** includes a pump housing **671** having an inlet conduit **672**, an open end **674**, and an outlet conduit **675**. A one way check valve is provided upstream of the inlet conduit **672**. The one way check valve prevents liquid from flowing away from the inlet conduit **672** such that the pump remains primed and liquid does not flow back into the bottle **616**. Hollow tubing **653** places the first tubular conduit **635** of the bottle coupler **630** and the inlet conduit **672** of the pump **670** in fluid communication. A pump cylinder **677** is located in the pump housing **671** as shown in FIGS. **9** and **10**. A piston **679** reciprocates in the pump cylinder **677**, and a piston seal **680** assures a sealing fit against the inner surface of the pump cylinder **677** during operation of the pump **670**. A cover **681** closes off the open end **674** of the pump **670** with an O-ring **682** providing a fluid tight seal. The pump **670** includes a pump drive shaft **685** having an eccentric **686** with a downwardly extending pin **687**. The pump **670** also includes a push rod **689** having an oblong end **690** with an opening **691** and having a stem **692** that connects the oblong end **690** with the piston **679**.

Looking at FIGS. **7** and **8**, the pump **670** has a direct current motor **694** having a single drive shaft **695**. Suitable wiring (not shown) places the motor **694** in electrical communication with a controller. Wiring (not shown) also places the batteries in the battery compartments **625***a*, **625***b* in electrical communication with the controller. Wiring (not shown) also places the actuator button **659** in electrical communication with the controller. The functioning of the controller will be described below.

Referring now to FIGS. **7** and **8**, the sprayer **610** also includes a gear box assembly **701** for transmitting mechanical power from the motor **694** to the pump **670**. The gear box assembly **701** includes a case having a lower case section **702** and a mating upper case section **703**. A gear drive train **705** is housed in the case. Looking at FIG. **8**, the gear drive train **705** includes a pinion gear **707** coupled to the drive shaft **695** of the motor **694**. Gears **709***a*, **790***b*, **709***c*, **709***d*, **709***e* and **709***f* transmit rotation of the pinion gear **707** to a drive gear **711**. The gear drive train **705** also includes a pump drive gear **713** that is coupled to a shaft **714**. Gears **715***a*, **715***b* transmit rotation from the drive gear **711** to the pump drive gear **713**. Hollow tubing **718** (see FIG. **9**) connects the fluid pathway **231** and the outlet conduit **675** of the pump **670** to place the fluid pathway **231** and the pump **670** in fluid communication. The drive gear **711** may also be coupled to suitable linkage for rotating the nozzle **222**. The motor **223** may also be used for rotating the nozzle **222**.

The gear box assembly **701** may include a different number of gears in meshing relationship, and axles can be operably connected to the gears. The gear box assembly **701** provides a linkage for transferring rotational movement of the drive shaft **695** of the motor **694** to the pump **670**. While one example of a suitable gear/axle configuration is depicted in FIG. **8**, it should be appreciated that any other suitable gears and linkages may be provided to transfer movement of the motor drive shaft **695** to components of the automated sprayer **610**.

Having described the construction of the automated sprayer **610**, the liquid flow path through the sprayer **610** can be explained. When the pump **670** is activated, liquid flows upward from the bottle **616** (though any dip tube if provided), through the neck **617**, into the interior space of the bottle coupler **630**, and through the first tubular conduit **635**. Liquid exiting the first tubular conduit **635** flows through hollow tubing **653** past a one way check valve and into the inlet conduit **672** of the pump **670**. Looking at FIG. **10**, the push rod **689** and attached piston **679** reciprocate from the position shown in full lines to the position shown in broken lines. When the push rod **689** and attached piston **679** move from the position shown in broken lines to the position shown in full lines, the liquid is drawn into the pump cylinder **677** (the upward facing arrows and the top rightward facing arrow in FIG. **9** show this). When the push rod **689** and attached piston **679** move from the position shown in full lines to the position shown in broken lines in FIG. **10**,

the liquid is expelled from the pump cylinder **677** (the lower rightward facing arrow in FIG. **9** show this). The liquid then enters the hollow tubing **718** after passing through the outlet conduit **675** of the pump **670**. After passing through the tubing **718**, the liquid enters the fluid pathway **231**. The liquid flows through the fluid pathway **231** and then into the nozzle assembly **220** thereby spraying liquid from the sprayer **610** onto the walls of the toilet bowl **250**.

Having described the components and fluid flow path of the automated sprayer **610**, operation of the sprayer **610** can be explained further. Referring to the functional flow diagram of FIG. **12**, in a first step **400**, a user inserts batteries into the battery compartments **625***a*, **625***b*. Battery compartments and their wiring to the controller are known in the art and therefore will not be explained further. In a second step **402**, the bottle **616** is installed in the lower housing section **622** thereby completing a circuit to supply electrical power from batteries to the controller. This results in a reset of all controller system counters and fault conditions, and causes an LED to flash to indicate to the user that the sprayer **610** has properly powered up. The LED then remains on.

The software routine then advances to step **406**. The sprayer **610** should function until the average battery voltage reaches a lower threshold voltage when the pump **670** is not running. In step **406**, the controller checks the available battery voltage. If the battery voltage is below a predetermined value, a low voltage shutdown occurs at step **408** prior to controller microprocessor loss. In step **408**, the LED is turned off and a power down sequence occurs. If the battery voltage is at or above a predetermined value, the routine proceeds to step **410**.

At step **410**, the controller responds to any manual cycle request from the pressing of the actuator button **659**. If the actuator button **659** has been pressed, the routine advances to step **412**. The manual cycle will dispense cleaning solution 5 seconds after the depression and release of the actuator button **659** providing there are no objects (e.g., people or pets) on or near the toilet bowl as detected by the sensor **24**. At step **412**, the LED will flash after the actuator button **659** has been pressed, and the controller will ignore the sensor **24** for 4.5 seconds (which allows a person to leave the area after the actuator button **659** has been pressed). At step **414**, the controller receives signals from a sensing circuit of the sensor **24**. If no signal is received by the controller from the sensor **24** that indicates the presence of an object near the toilet bowl, the routine proceeds to step **416** in which the controller provides electrical current to the motor **694** to deliver fluid to the nozzle assembly **220** to be dispensed onto the inside surface of the toilet bowl as described above. The controller can provide electrical current to the motor **694** for any selected time period depending on the amount of fluid that is desired to be dispensed onto the inside surface of the toilet bowl. One non-limiting example of a pumping time period is 1 second after which the routine moves to step **418**. If a signal is received in step **414** by the controller from the sensor **24** that indicates the presence of an object near the toilet bowl **250**, the routine proceeds to step **418** in which the controller refrains from providing electrical current to the motor **694**. After step **418**, the routine proceeds back to step **406**.

When step **406** indicates that the battery voltage is not low and step **410** indicates that a manual cycle request has not been initiated by pressing the actuator button **659**, the routine proceeds to step **422**. At step **422**, the controller checks the sensor **24** to determine if a user has entered the region of the toilet bowl and then exited the region of the toilet bowl. If no exit is detected, the routine proceeds back to step **406**.

If a user has exited the area of the toilet bowl, at step **426**, the controller indicates that an automatic dispensing is to occur, and the routine proceeds to step **428**. During step **428**, the controller also performs step **430** in which the controller monitors signals from the sensor **24**. If the signals from the sensor **24** indicate the presence of an object near the toilet bowl, the routine proceeds back to step **406**. If no signals from the sensor **24** indicate the presence of an object near the toilet bowl, the controller proceeds to step **432** in which current is provided to the motor **694** to deliver fluid to the nozzle assembly **220** to be dispensed onto the inside surface of the toilet bowl as described above. The routine proceeds back to step **406**.

In an alternative control program, step **422** is removed and at step **426**, the controller checks the time count of an automatic discharge timer that was started on the reset of all controller system counters and fault conditions. If the time count of the automatic discharge timer indicates that an automatic dispensing is not yet to occur, the routine proceeds back to step **406**. If the time count of the automatic discharge timer indicates that an automatic dispensing is to occur (e.g., an eight hour dispensing interval has been reached), the routine proceeds to step **428**. During step **428**, the controller also performs step **430** in which the controller monitors signals from the sensor **24**. If the signals from the sensor **24** indicate the presence of an object near the toilet bowl, the routine proceeds back to step **406**. If no signals from the sensor **24** indicate the presence of an object near the toilet bowl, the controller proceeds to step **432** in which current is provided to the motor **694** to deliver fluid to the nozzle assembly **220** to be dispensed onto the inside surface of the toilet bowl as described above. At step **432**, the timer may be restarted on a second automatic discharge that will take place 8 hours from the end of the pumping time period. The routine proceeds back to step **406**.

With regard to fastening, mounting, attaching or connecting components of the present invention to form the automated sprayer or components thereof, in accordance with some embodiments of the present invention, unless specifically described otherwise, such are intended to encompass conventional fasteners such as screw threads, threaded connectors, snap rings, detent arrangements, clamps, pins and the like. Components may also be connected by adhesives, glues, welding, ultrasonic welding, and friction fitting or deformation, if appropriate, and appropriate liquid and/or airtight seals or sealing devices may be used. Any electronic portions in accordance with the present invention may use conventional, commercially available electronic components, connectors and devices such as suitable wiring, connectors, printed circuit boards, microchips, sensors, inputs, outputs and the like. Electrical and other components of the invention may be isolated, contained and/or sealed in one or more water and/or fluid-tight chambers, coatings or structures based on environmental or dispensing requirements (e.g., the place of dispensing, the substance to be dispensed, etc.), for example, to prevent or minimize corrosion, leakage, contamination, etc. Unless specifically otherwise disclosed or taught, materials for making the present invention and/or components thereof may be selected from appropriate materials such as metal, metallic alloys, ceramics, plastics and the like, and appropriate manufacturing or production methods including casting, pressing, extruding, molding and machining maybe used.

In the foregoing description, embodiments of the present invention, have been presented for the purpose of illustration and description. They are not intended to be exhaustive or to limit the invention to the precise forms disclosed. Obvious modifications or variations are possible in light of the above teachings. The embodiments were chosen and described to provide the best illustrations of the principals of the invention and its practical application, and to enable one of ordinary skill in the art to utilize the invention in various embodiments and with various modifications as are suited to the particular use contemplated. All such modifications and variations are within the scope of the invention as determined by the appended claims when interpreted in accordance with the breadth they are fairly, legally, and equitably entitled.

INDUSTRIAL APPLICABILITY

The present invention provides a sprayer for automatically spraying the walls of an enclosure, such as a toilet bowl, and the like.

What is claimed is:

1. A device for spraying an inner surface of a wall of an enclosure with a fluid, the device comprising:

a reservoir for the fluid;

a nozzle assembly including a nozzle through which the fluid can be sprayed on the inner surface of the wall of the enclosure, the nozzle assembly including mounting structure for attaching the nozzle near the inner surface of the wall of the enclosure, the nozzle assembly including a deflector shield wherein the deflector shield directs fluid through the nozzle in a laminar flow;

a fluid conduit in fluid communication with the reservoir and the nozzle;

a pump for delivering fluid from the reservoir through the fluid conduit and to the nozzle when the pump is activated;

a controller in electrical communication with the pump, the controller executing a stored program to activate and deactivate the pump; and

a vent assembly in fluid communication with an interior space of the reservoir, the vent assembly comprising a valve wherein the valve opens by negative pressure that develops as fluid is withdrawn from the reservoir and closes when the pressure in the reservoir has equalized.

2. The device of claim **1** wherein the valve is an actuator assist valve.

3. The device of claim **1** wherein the controller activates the pump based on a scheduled spraying time stored in the controller.

4. The device of claim **1** wherein the controller activates the pump when a manual actuator is actuated.

5. The device of claim **1** wherein fluid flowing into the nozzle assembly and out of the nozzle effects rotation of the nozzle.

6. The device of claim **1** wherein the nozzle assembly further comprises:

a motor to effect rotation of the nozzle.

7. The device of claim **1** wherein the enclosure is a toilet.

8. A device for spraying an inner surface of a wall of a toilet bowl with a fluid, the device comprising:

a reservoir for the fluid;

a nozzle assembly including a nozzle through which the fluid can be sprayed on the inner surface of the wall of the toilet bowl, the nozzle assembly including mounting structure for attaching the nozzle near the inner surface of the wall of the toilet bowl, the nozzle assembly including a deflector shield wherein the deflector shield directs fluid through the nozzle in a laminar flow;

a fluid conduit in fluid communication with the reservoir and the nozzle;

a pump for delivering fluid from the container through the fluid conduit and to the nozzle when the pump is activated;

a pressure sensor disposed on the nozzle assembly for detecting unseating of a person from the toilet; and

a controller in electrical communication with the pump, the sensor, and a source of electricity, wherein the controller executes a stored program to:

(i) monitor electrical signals from the sensor to determine when a person unseats from the toilet; and

(ii) if the controller determines that a person has unseated from the toilet, activate the pump for a pump cycle time for delivering fluid from the reservoir through the fluid conduit and to the nozzle.

9. The device of claim **8** where the sensor is an infrared sensor that emits an actuation signal upon a predetermined change in light intensity.

10. The device of claim **8** wherein the controller activates the pump when a manual actuator is actuated.

11. The device of claim **8** wherein force of the fluid flowing into the nozzle assembly and out of the nozzle effects rotation of the nozzle.

12. The device of claim **8** wherein the nozzle assembly comprises:

a motor to effect rotation of the nozzle.

13. A device for spraying an inner surface of a toilet bowl with a fluid, the device comprising:

a reservoir for the fluid;

a pressure sensor disposed on the nozzle assembly for detecting unseating of a person from the toilet;

a nozzle assembly including a nozzle through which the fluid can be sprayed on the inner surface of the toilet bowl, the nozzle assembly including mounting structure for attaching the nozzle near the inner surface of the toilet bowl, the nozzle assembly including a deflector shield wherein the deflector shield directs fluid through the nozzle in a laminar flow;

a pump for delivering fluid from the reservoir through the fluid conduit and to the nozzle when the pump is activated; and

a controller in electrical communication with the pump, the controller executing a stored program to activate and deactivate the pump,

wherein the nozzle assembly further includes a housing connected to the mounting structure, the housing containing the pump and the controller.

14. The device of claim **13** wherein:

the controller activates the pump based on a scheduled spraying time stored in the controller.

15. The device of claim **13** wherein:

the controller activates the pump when a manual actuator is actuated.

16. The device of claim **13** wherein:

force of the fluid flowing into the nozzle assembly and out of the nozzle effects rotation of the nozzle.

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